

FABRICATION OF AIR FILLING MECHANISM IN FOUR WHEELERS

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Abstract: The main aim of our project is to develop an “Automatic tire inflation and deflation system” that can be placed in all automobiles traveling for long distances and can be utilized while climbing uphill or downhill. It is very necessary for every automobile to be cautious while driving over long distances. Here suddenly when the air decreases in the automobile, a sensor signal is alerted to the person to use the air tank to fill the air.

Keywords: Four Wheeler, Compressed Air, fuel consumption, tire pressure, fuel consumption, vehicle safety

I. Introduction

The “Automatic tire inflation and deflation system” is a Mechanical device which is widely used in automobile works. The manual work increases the effort of the manpower (operator) during the air checking in vehicles. The Air Maintenance Technology system developed through this project replenishes lost air and maintains optimal tire cavity pressure whenever the tire is rolling in service, thus improving overall fuel economy by reducing the tire’s rolling resistance. Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources, pneumatics form an attractive medium for low-cost automation.

Today automobile sector plays a big role in the economics of all the countries in the world and lots of researches have been carried out to improve the efficiency of the vehicle one the techniques to improve the efficiency of an automobile is inflate the tire regularly. As is well-known, one of the most serious problems that the large motor vehicle have whether they are for the transportation of passenger or cargo and especially those used for middle or long-distance travel resides the ensuring the correct performance of the tires. This means making sure that tire is inflated and stay inflated for the right amount of pressure for the load being carried and for road condition this way one can ensure not only the preservation of outer covering of the tires but also the correct operation of vehicle without any risks.

The deflation is a process of letting air or gas out of the tires. Deflation is the problem of an automobile vehicle. Because a certain period of time in air reduced to the vehicle for running time. So a long distance traveled vehicle scar able things for deflation. The air is also decreasing the tire. Fleet tire managers typically ask how frequently they should be checking tire pressure and loss so much of air during the course of the year. Osmosis of air through the tire casing can lead to a loss 1to 3 PSI per month, depending on the specific tire make and model. The type of compounds used in the manufacture of the tire can have a big impact on osmosis. The composition and gauge of the tire inner liner compound also play a significance in osmosis.

II. WORKING PRINCIPLE

If any prickle occurs in the tire of our vehicle, we get a gradual decrease in the tire pressure which obstructs our drive which may lead to an accident. Also at times, if we are stuck in some situation where we cannot get an immediate aid for the problem, this system is very useful and helpful for the purpose. In this system with a decrease in pressure, the sensor senses the pressure change and actuates the non-return valve which allows the compressed air from the compressor to pass to the tire from the LPC to make the pressure equal to the required pressure. Once the pressure gets equalized, the sensor cuts off the supply of compressed air by closing the non-return valve.

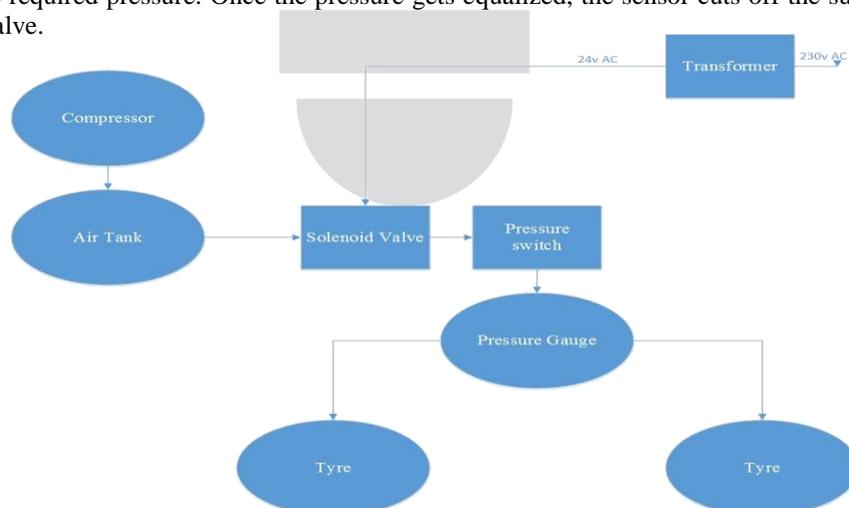


Fig. 1- Block Diagram

In this system, the compressor is connected to the wheel with the help of hoses through a rotary joint. Pressure sensor and control circuit are connected between the wheel and compressor. Two limits (upper limit and lower limit i.e. 20psi and 30 psi respectively) are set in the control circuit for automatic start and stop of the compressor. The compressor works on 12V DC supply that is either a car battery or bike or an adapter. A non-return valve is connected between the pressure sensor and compressor so that the air flow must be unidirectional from the compressor to tire.

When the pressure reduces below the lower limit (20psi) in the tire during its rotation, pressure sensor senses this drop and starts the compressor automatically for the filling air into the tire with the help of control circuit. As soon as the pressure crosses the set upper limit (30psi), the compressor stops working with the help of the pressure sensor and control circuit. In this way, proper required tire pressure is maintained.

I. COMPONENTS AND THEIR WORKING

a. Reciprocating Compressor

Pneumatic systems operate on a supply of compressed air, which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. part of any for a supply of compressed air is by means using the reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivers it at a higher pressure. Compressor capacity is the actual quantity of air compressed and delivered. And the volume expressed is that of the air at intake conditions namely at atmospheric pressure and normal ambient temperature. A clean condition of the suction air is one of the factors, which decides the life of a compressor. Warm and moist suction air will result in increased precipitation of condensing from the compressed air.

Built for either stationary (or) portable service the reciprocating compressor is by far the most common type. Reciprocating compressors deliver more than 500 m³/min. In single stage compressor, even if the air pressure is of 6 bar, the machines can discharge pressure of 15 bars. Discharge pressure in the range of 250 bars can be obtained with high-pressure reciprocating compressors that of three & four stages. Single stage and 1200 stage models are particularly suitable for pneumatic applications, with preferences going to the two-stage design as soon as the discharge pressure exceeds 6 bar, because of it incapable of matching the performance of single stage machine at lower costs per driving powers in the range.



Fig. 2 Compressors

b. Solenoid Valve

A solenoid valve is an electromechanically controlled valve. The valve features a solenoid, which is an electric coil with a movable ferromagnetic core in its center. This core is called the plunger. In the rest position, the plunger closes off a small orifice. An electric current through the coil creates a magnetic field. The magnetic field exerts a force on the plunger. As a result, the plunger is pulled toward the center of the coil so that the orifice opens. This is the basic principle that is used to open and close solenoid valves. Solenoids valves are used to close, dose, distribute or mix the flow of gas or liquid in a pipe. The specific purpose of a solenoid valve is expressed by its circuit function. A 3/2 way valve has three ports and two positions and can, therefore, switch between two circuits. 3/2 way valves can have different functions such as normally closed, normally open, diverting or universal.



Fig. 3 - Solenoid Valve

Direct operated 3/2 way

A 3/2 way solenoid valve has three ports and two switching states. In each switching state, two of the three ports are connected. By activating the solenoid, the valve switches state and a different connection between the valve ports is established. The drawing below shows a direct operated 3/2 way valve. In the de-energized state, the medium can flow between from the port on the right side to the top port. In the energized state, the medium can flow from the left port to the right port. This is a called a normally closed 3/2-way valve.

C. Pressure Switch

The air compressor pressure switch helps to measure the pressure inside your air tank and then is used to shut off your compressor when your air tank reaches the desired air pressure.

The air compressor pressure switch will also help your machinery maintain the proper pressure level as you go about your work. The switch can turn on your compressor when tanking air pressure levels drop and more air is needed.



Fig. 4- Pressure switch

This makes your air compressor pressure switch a part that gets used often, and so it may wear down sooner than others. You'll want to keep it properly maintained and fix it, or replace it when any problems arise. The switch is your best protection against an over-pressurized tank and airlines for your compressor, keeping you safe from ruptures and dangers.

Working of pressure switch: -Air compressor pressure switches use airlines to monitor pressurized air as it moves to and from your air tank. All pressure switches have some element that reacts when pressure is applied to it. The most common device is a diaphragm that will physically compress when exposed to this air.

Air pressure in your compressor tank will increase and eventually build up enough backward pressure also called cut-out pressure to change the shape of this diaphragm. Deformation here will cause movement in the pressure switch.

When your air compressor pressure switch's diaphragm is deformed enough, its movement will break contact inside the switch so that power stops flowing to the compressor's motor circuit, stopping the compressor from further pressurizing the air in your tank.

Constant air pressure at a specific volume will keep the diaphragm deformed. When the air pressure in your tank drops far enough, the diaphragm will revert back to its normal shape. Once this pressure called cut-in pressure lightens to a certain level, an internal operator within the diaphragm will deform in an opposite manner. This movement closes the circuit and starts the motor back up again.

Your air compressor pressure switch continues this dance as long as your machinery is using compressed air. The cycle is broken when the unit is no longer powered externally or when there is an issue. Leaks at any point in your compressor's pressure switch and nearby casing can stop your work and cause major problems.

d. Pressure gauge

Many techniques have been developed for the measurement of pressure and vacuum. Instruments used to measure and display pressure in an integral unit are called pressure gauges or vacuum gauge. A manometer is a good example as it uses a column of liquid to both measure and indicate pressure. Likewise, the widely used Bourdon gauge is a mechanical device which both measures and indicates and is probably the best-known type of gauge.



Fig. 5- Pressure gauge

e. Connectors

In our system hose connectors are used. Hose connectors normally comprise an adoptee hose nipple. These types of connectors are made up of brass (or) Aluminium (or) hardened pneumatic steel. For these type hose connectors no need of hose clamp these are self-locking hose connectors.

The universal combination at an attractive price. Can be widely used thanks to resistant materials. Easy to install thanks to optimized bending radii. Limited reset effect. Attractively priced the universal solution for metal fittings. Perfect for standard pneumatic applications in many different fields. The wide range of variants Over 1000 types for maximum flexibility in standard applications. Hydrolysis resistant For applications in damp environments or in contact with water at up to 60 °C. Resistant to pressure Secure connection when used with pressure ranges of up to 14 bar. Economical for pneumatic installations in the high-pressure ranges.



Fig. 6- Push back connector

The powerful combination for applications involving pressure ranges up to 16 bar For example, for applications with the pressure booster Robust, flexible and reliable connection for the automotive industry. Fulfills the requirements Heat resistant For reliable compressed air supply in high-temperature ranges. Whether with 10 bar at 80 °C or 6 bar at 150 °C – always delivers maximum process security. Anti-static Electrically conductive tubing combined with a solid-metal fitting Approved for the food Industry Food and Drug Administration certification for use in the food industry:



Fig. 7- T-joint

The hydrolysis-resistant combination with increased functions. Designed to meet the highest demands, This combination shines in applications which require the highest possible hygiene standards for food. The cost-effective alternative to stainless steel, perfect for e.g. critical environments such as the splash zone: resistant to practically all common cleaning agents, with maximum corrosion protection. Resistant to media completely resistant to all cleaning agents and lubricants and even permits the transportation of acids without any problems.

Flame-retardant Safe in areas where there is a risk of fire thanks to flame-retardant properties to Resistant to welding Spatter The economical combination for applications not in close proximity to welding applications. Also reliable for applications in direct proximity to welding splatter Double-sheathed tube and special fitting.

f. Hoses

Hoses used in this pneumatic system are made up of polyurethane. These hose can withstand at a maximum pressure level of 10 N/m². Polyurethane combines the best properties of both plastic and rubber. It offers abrasion and tears resistance, high tensile and elongation values, and low compression set.

Polyurethane is naturally flexible and exhibits virtually unlimited flexural abilities. Combining good chemical resistance with excellent weathering characteristics sets polyurethane apart from most other thermoplastics. It has exceptional resistance to most gasoline, oils, kerosene, and other petroleum-based chemicals, making it an ideal choice for fuel lines (although additives in today's gasoline and petroleum products warrant field testing).



Fig. 8- PU Pipe

g. Bearing

A bearing is a machine element that constrains relative motion to only the desired motion and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around

a fixed axis; or, it may prevent motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.



Fig. 9- Bearing & holder

h. Wheel:

In this system 2 scooter wheels are used for rear drive & one castor wheel are used for front. DC motor with chain drive is connected to the rear 2 wheels.



Fig. 10- wheel

i. Rotary element

Rotary joint or a Rotary Union is a device that provides a seal between a stationary passage and a rotating part. The stationary passage may be a pipe or tubing; whereas rotating part can be a drum, spindle or a cylinder. Thus it permits the flow of the fluid into and/or out of the rotating part. Generally, the fluids that are used with the rotary joints and rotating unions are steam, water, thermal oil, hydraulic fluids etc. A rotary union will lock onto an input valve while rotating to meet an outlet. During this time the liquid and/or gas will flow into the rotary union from its source and will be held within the device during its movement. This liquid and/or gas will leave the union when the valve openings meet during rotation and more liquid and/or gas will flow into the union again for the next rotation.



Fig. 11- rotary element

II. Swot Analysis:

- SWOT Analysis is a useful technique for understanding our Strengths and Weaknesses, and for identifying both the Opportunities open to you and the Threats you face.
- SWOT is a strategic planning tool used to evaluate the strengths, weaknesses, opportunities, and threats to a project. It involves specifying the objective of the project and identifying the internal and external factors that are favorable and unfavorable to achieving that objective. The strengths and weaknesses usually arise from within an organization, and the opportunities and threats from external sources.

- What makes SWOT particularly powerful is that, with a little thought, it can help you uncover opportunities that you are well-placed to exploit. And by understanding the weaknesses of our project, you can manage and eliminate threats that would otherwise catch you unawares.
- More than this, by looking at our self and our competitors using the SWOT framework, we can start to craft a strategy that helps you distinguish our self from your competitors so that we can compete successfully in your market.

➤ **Advantages of SWOT**

- Straightforward and only costs time to do.
- Produces new ideas to help take advantage of an organization's strengths and defends against threats.
- Awareness of political and environmental threats allows an organization to have response plans prepared.

➤ **Disadvantages of SWOT**

- May persuade organizations to compile lists rather than think about what is essential to achieving objectives.
- Presents lists uncritically and without clear prioritization so, for example, weak opportunities may appear to balance strong threats.
- Usually, a simple list and not critically presented.

Figure swot analysis

➤ **Strengths and Weaknesses:** These are the internal factors within an organization.

- Human resources - staff, volunteers, board members, target population
- Physical resources - your location, building, equipment
- Financial - grants, funding agencies, other sources of income
- Activities and processes - programs you run, systems you employ
- Past experiences - building blocks for learning and success, your reputation in the community

➤ **Opportunities and Threats:** These are external factors stemming from community or societal forces.

- Future trends in your field or the culture
- The economy - local, national, or international
- Funding sources - foundations, donors, legislatures
- Demographics - changes in the age, race, gender, culture of those you serve or in

III. Advantages:

- The dynamically-self-inflating tire system would be capable of succeeding as a new product in the automotive supplier industry. It specifically addresses the needs of the consumers by maintaining appropriate tire pressure conditions for:
 - Reduced tire wear
 - Increased fuel economy up to 15%.
 - Increased overall vehicle safety
- Because such a product does not currently exist for the majority of passenger vehicles, the market conditions would be favorable for the introduction of a self-inflating tire system.
- Through extensive engineering analysis, it has also been determined that the self-inflating tire system would actually function as desired. In particular, the product would be capable of:
 - Providing sufficient airflow to the tire with minimal leakage withstanding the static and dynamic loading exerted on the rotary joints.

IV. Applications

- It can be used in military vehicles.
- It can be used in emergency vehicles like ambulance, police vehicles and fire vehicles.

- It can be used in trucks and trailers.
- It can be used in very costly vehicles where maintenance of standard is important.
- It can be used in sports cars as there is a need for regular checking of air pressure in tires.

V. CONCLUSION

Central tire inflation systems have many advantageous benefits in the transportation industry. These benefits include, improved vehicle mobility due to the increase in traction when tire pressures are lowered, improved ride quality and cargo safety due to the reduction in vehicle vibrations when the correct tire pressure is used for a particular road condition, reduced road maintenance because sediment production is limited and lowered road construction costs, increased fuel efficiency and a considerable increase in the tyre life of vehicles. All these benefits contribute to a considerable cost saving in the overall operation of a transportation vehicle.

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